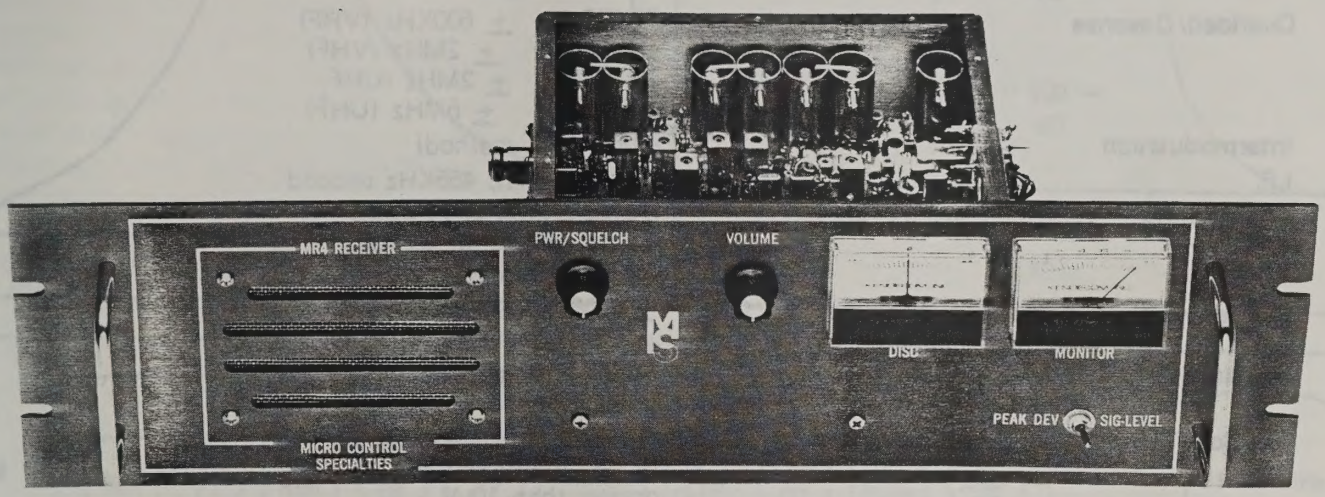
MICRO CONTROL SPECIALTIES
SERIES MR4 RECEIVER



COMPARE THESE MR4 FEATURES

- 7 large helical resonators for outstanding overload performance
- Double conversion with 21.4 MHz first IF for 120 dB image rejection
- 12-pole crystal and ceramic IF filter
- Automatic fast/slow squelch virtually eliminates squelch tail
- Squelch hysteresis follows fading signals
- Shielded oscillator/multiplier chain
- Metering circuits for signal strength, peak deviation, and discriminator
- Silver mica and mylar capacitors hold peak performance over temperature
- Provision for internal CTCSS decoder
- Feedback and Q-damping insures optimum performance over time and temperature

DESCRIPTION

Radio channels are crowded enough today -- tomorrow the congestion will be even worse. That's why every detail of the MR4 is designed for outstanding performance in the harshest RF environments. With 7 large helical filters in the front-end and 12 poles of IF filtering the MR4 is immune to desense at interference levels greater than 100,000 uV. Two of the resonators are placed ahead of the RF pre-amplifier for exceptional overload resistance. The 21.4 MHz first IF and shielded oscillator/multiplier chain make it difficult to even measure an image, and its double-balanced first and second mixers reject intermodulation products by 80 dB. Feedback, damped-Q tuned circuits and decoupling are used so that gain stages operate conservatively -- not wide open. NPO and mylar capacitors keep the performance consistantly high over temperature extremes.

The MR4 is also packed with operational features like our famous MCS squelch circuit which is often called "the best there is." Now we've added automatic fast/slow squelch to lock in on weak signals and virtually eliminate squelch tails on strong signals. Full metering provisions for signal strength, deviation, and discriminator are included as are line and local speaker audio outputs.

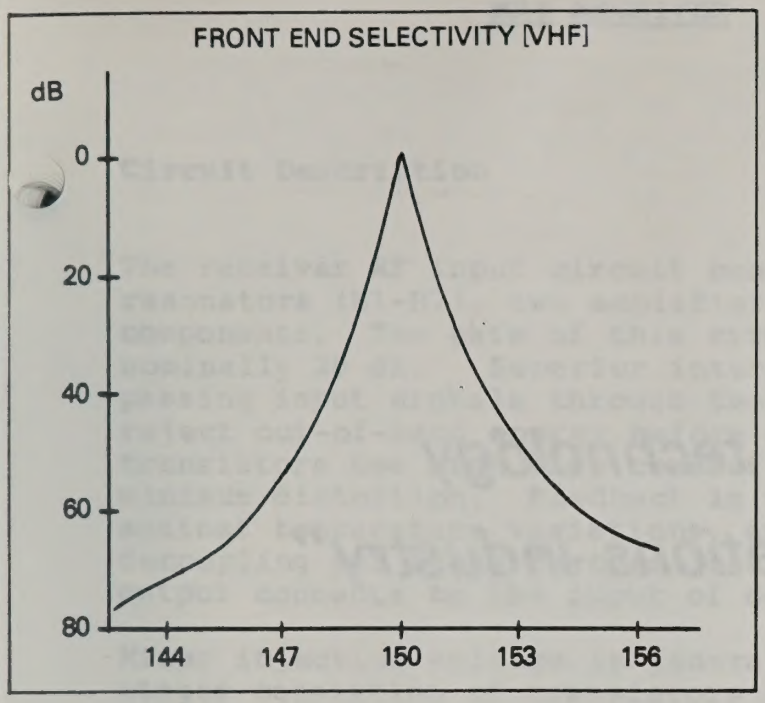
Compare all the MR4 specs with those of any other receiver. Nothing else matches the MR4!

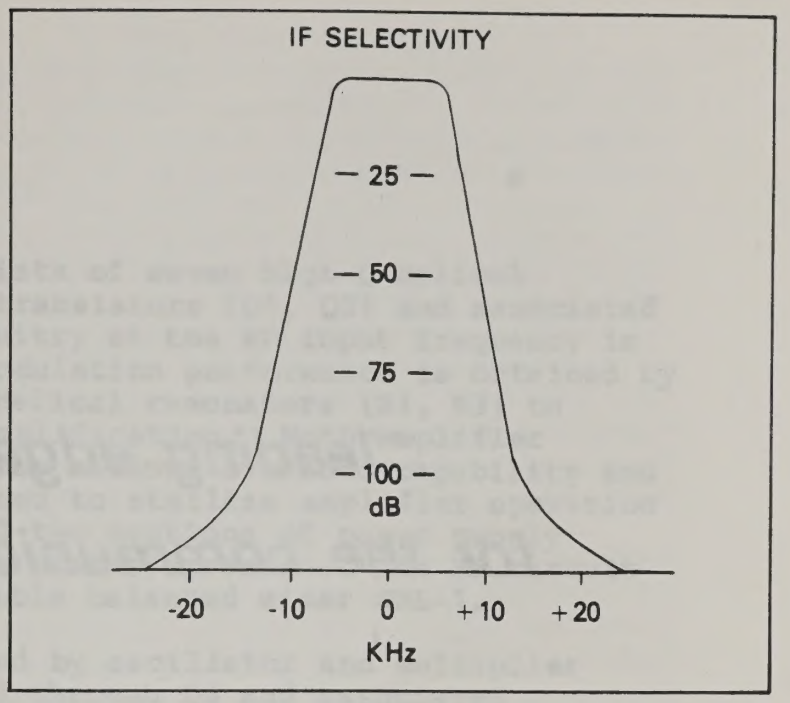
SPECIFICATIONS

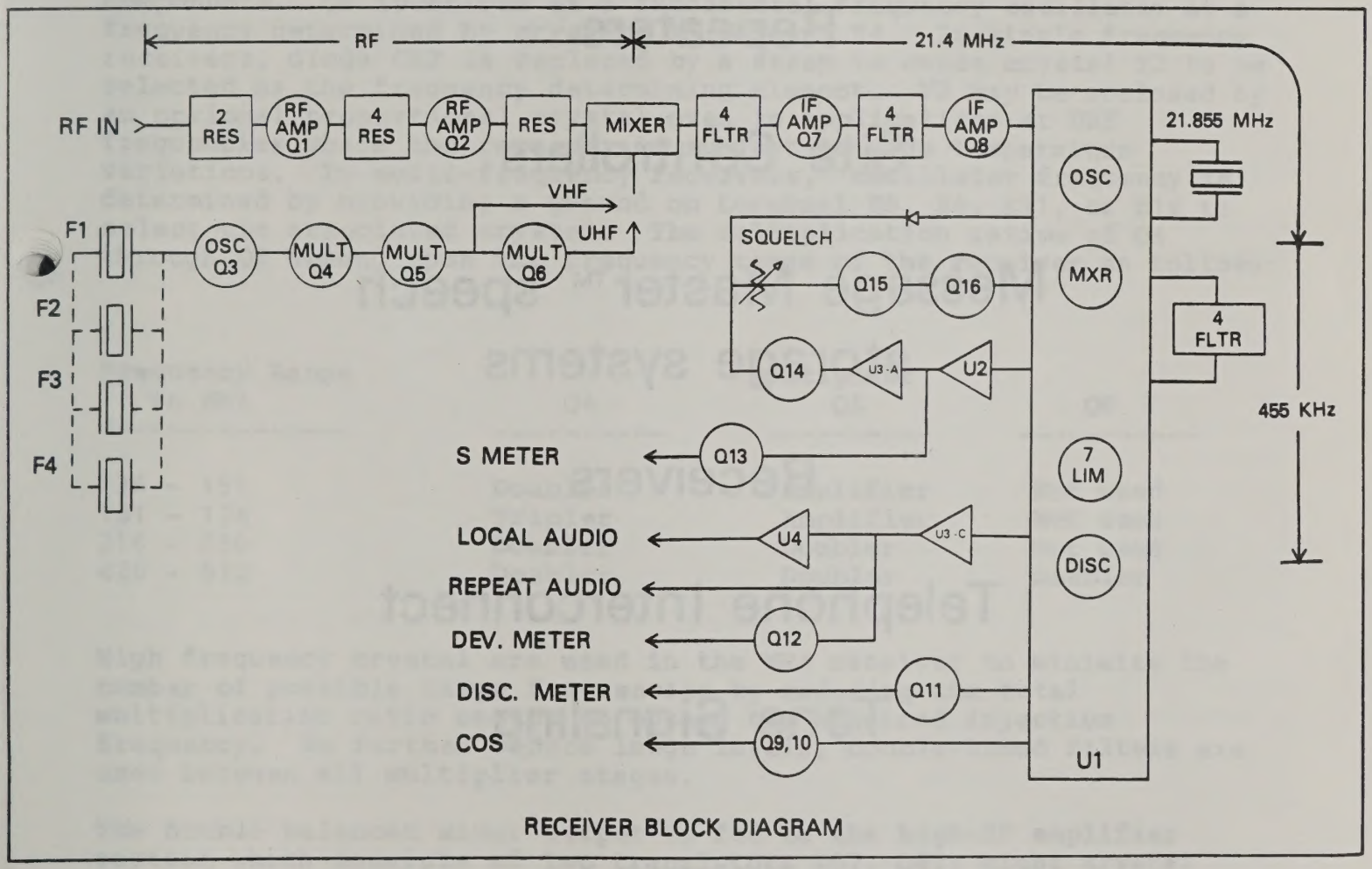
Frequency Range	136-174MHz, 216-250MHz (VHF) 420-512MHz (UHF)
Sensitivity	.25-.35uV (typ.) for 12dB SINAD
Selectivity	-6dB at ± 6.5KHz -105dB at ± 15KHz -125dB at ± 25KHz
Spurious and Image response	-85dB Spurious -125dB Image
Overload/Desense	75,000uV ± 600KHz (VHF) 100,000uV ± 2MHz (VHF) 75,000uV ± 2MHz (UHF) 100,000uV ± 5MHz (UHF)
Intermodulation	-80dB (EIA method)
I.F.	21.4MHz first, 455KHz second
I.F. Filtering	8-pole crystal at 21.4MHz 4-pole ceramic at 455KHz (optional 9-pole ceramic)
First oscillator stability	±.0005% (-10 to +60C) ±.0002% with optional oven
Squelch Circuit	Schmitt trigger with 6dB hysteresis
Squelch Threshold	.1-.15uV, automatic switch to fast mode with signals greater than 10uV
Modulation acceptance	±7KHz
Audio de-emphasis	-6dB/octave (EIA)
Audio output	1.5W into 4Ω (local) 0.4Vrms, 1000Ω (line/repeat)
External Controls	50KΩ squelch 100 Ω local audio
External metering	0-1mA, 2300Ω for each function
COS output	open collector, selectable active high or low
Voltage required	13VDC nominal (11-14VDC limit)
Current Drain	180mA squelched 200mA nominal unsquelched 250mA with full audio output
Crystal specification	136-151MHz Fx = (Fo−21.4MHz) /2 151-174MHz Fx = (Fo-21.4MHz) /3 216-250MHz Fx = (Fo−21.4MHz) /4 420-512MHz Fx = (Fo-21.4MHz) /8 Parallel resonant, third overtone, resistance 30Ω max., 12pF load capacity, HC-25/U case
Physical [modular version]	5''x7.25''x2.5'' enclosure w/ feedthru capacitors & UHF connector
Physical [rack version]	19''x5.25'' rack panel, 5'' deep includes meters, controls, and speaker

Specifications subject to change without notice

MR4 receivers are factory tested, aligned, and tuned to frequency before shipment. They are engineered to give years of reliable service with no periodic adjustment or maintenance. Their one year limited warranty is our statement of commitment to quality.







RECEIVER BLOCK DIAGRAM

MICRO CONTROL SPECIALTIES

DIV. OF KENDECOM INC.

23 Elm Park, Groveland, MA 01834 (508) 372-3442
Kendecom Fax: (508) 373-7304

"leading edge technology for the communications industry"

Repeaters

Site Controllers

Message Master™ speech storage systems

Receivers

Telephone Interconnect

Tone Signaling

Circuit Description

The receiver RF input circuit consists of seven high-Q helical resonators (H1-H7), two amplifier transistors (Q1, Q2) and associated components. The gain of this circuitry at the RF input frequency is nominally 20 dB. Superior intermodulation performance is obtained by passing input signals through two helical resonators (H1, H2) to reject out-of-band energy before amplification. Both amplifier transistors use high bias current for maximum overload capability and minimum distortion. Feedback is used to stailize amplifier operation against temperature variations, and two sections of power supply decoupling per stage further insure stable operaion. The RF circuit output connects to the input of double balanced mixer SBL-1.

Mixer injection voltage is generated by oscillator and multiplier stages consisting of transistors Q3 through Q6 and associated components. Q3 fucntions as a fundamental frequency oscillator at a frequency determined by crystals Y1 through Y4. In single frequency receivers, diode CR2 is replaced by a strap to cause crystal Y2 to be selected as the frequency determining element. Y2 may be enclosed by an optional proportional crystal oven in applications at UHF frequencies where the receiver is subject to wide temperature variations. In multi-frequency receivers, oscillator frequency is determined by providing a ground on terminal E5, E8, E11, or E14 to select the associated crystal. The multiplication ratios of Q4 through Q6 depend upon the frequency range of the receiver as follows:

Frequency Range in MHz	Multiplier Q4	Q5	Q6
136 - 151	Doubler	Amplifier	Not used
151 - 174	Tripler	Amplifier	Not used
216 - 250	Doubler	Doubler	Not used
420 - 512	Doubler	Doubler	Doubler

High frequency crystal are used in the MR4 receiver to minimize the number of possible image frequencies by reducing the total multiplication ratio needed to obtain the required injection frequency. To further reduce image levels, double-tuned filters are used between all multiplier stages.

The double balanced mixer output is fed to the high-IF amplifier section which consists of two transistors (Q7, Q8), eight crystal filter sections, and associated components ('B' version command receivers use four filter sections.) The high-IF operates at a frequency of 21.4 MHz. Both amplifier stage outputs include broadly

tuned resonant circuits (L24, C60 and L27, C66 respectively) to reject signals at frequencies beyond the skirts of the ceramic filters. Generous feedback and decoupling desensitize the amplifiers to temperature and power supply effects.

Conversion from high to low IF frequencies, amplification at the low IF frequency, limiting, and detection is done by integrated circuit U1 (squelch circuitry in U1 is not used). Frequency conversion is controlled by crystal Y5 which operates in conjuction with oscillator circuitry contained in U1. Four pole ceramic filter FL-9 operates at the low IF frequency of 455 KHz to provide additional filtering. Seven amplifier stages contained in U1 provide excellent limiting before detection. Detection is done by discriminator circuitry contained in U1 operating in conjunction with coil L28.

Wideband demodulated audio from U1 is detected by diodes CR5 and CR6 to provide the primary voltage reference for squelch operation. This detected voltage is fed to a Schmitt trigger circuit consisting of transistors Q15 and Q16. Hysteresis in the Schmitt trigger produces positive squelch action by requiring a change of about 6 dB in noise level before receiver audio is switched from off to on. The detected reference voltage is applied to the Schmitt trigger through squelch control R84 (R84 is external to the MR4.) Action of the Schmitt trigger can also be controlled by an external CTCSS decoder to disable receiver audio when no CTCSS signal is present. In applications where CTCSS operation in used, the CTCSS decoder output connects to terminal E33 to contol Schmitt trigger operation.

Squelch operation is further enhanced in the MR4 by automatically adjusting the squelch threshold in accordance with received signal level. Received signal at the low IF frequency is amplified by linear amplifier U2. detected by CR13/ CR14, level shifted by U3A, and fed to fast/slow squelch switch transistor Q14. When weak signals, less than 1 uV, are applied to the receiver transistor Q14 is turned on and applies a ground at terminal E30 to produce normal squelch action. When strong signals, greater than 1 uV, are applied to the receiver transistor Q14 is switched off. With Q14 turned off the reference voltage at the Schmitt trigger input is increased causing the squelch to be 'tightened.' 'Tightening' the squelch causes faster operation in response to signal changes and virtually eliminates squelch tail noise. Thus, the MR4 provides high squelch sensitivity to weak signals and noise-free operation for strong signals.

Output from the Schmitt trigger gates the audio output of U1. When a received signal is present audio from U1 is passed to amplifier U3C. Line audio is taken from the output of U3C at terminal E22. Audio from U3C is also routed to power amplifier U4 for driving a local speaker.

Metering circuits are provided to monitor signal strength, discriminator centering, and received signal peak deviation (Metering is not provided in version 'B' command receivers). All metering circuits are designed to drive 0-1 mA, 2200 Ohm panel meters. Signal strength metering is available at terminal E27 which is driven by DC amplifier transistor Q13. The signal strength meter indication is

calibrated using potentiometer R66. DC amplifier transistor Q11 drives terminal E20 to provide discriminator metering. Potentimeter R54 allows the discriminator meter to be set to mid-scale when registering an on-frequency signal. The discriminator meter negative terminal should be returned to ground through two series connected diodes. Diodes CR7 and CR8 are provided external to the receiver module for this purpose when the MR4 is factory installed in a repeater or rack panel. Audio is amplified, rectified by CR)/ CR10, and level shifted by Q12 to drive peak deivation metering outut terminal E26. Metering calibration is done using poteniometer R64.

Switched outputs indicating the presence of received signal are available from Q9 or Q10. Q10 provides a ground at terminal E16 when received signal is present and an open when no signal is present. An inverted output can be obtained by connecting a strap from terminal E16 to terminal E17 and taking the output from terminal E15.

Installation

The following describes connections which may be made to MR4 receivers furnished in modular form. Receivers furnished in repeaters are completely connected and require no field installation.

1. Connect to receiver terminals E34 (positive) and E35 (ground) from a DC power source having the following characteristics:

Nominal voltage	12 VDC
Regulation	+/- 5%
Ripple	< 100 mV
Current	250 mA

CAUTION: The MR4 uses negative ground and must be powered from a negative ground or floating power supply. DO NOT connect a positive ground power source to the receiver.

2. To obtain a fixed-level audio output (line audio) connect to terminals E22 (signal) and E23 (ground). This output provides a level of approximately 0.4 vrms and a source impedance of 1000 Ohms. Shielded wire should be used for making this connection.

3. To obtain power amplifier audio output for driving a loudspeaker connect to terminals E24 (signal) and E25 (ground). This output provides a fixed level of approximately 3 vrms. An external 100 Ohm potentiometer may be connected between this output and the loudspeaker, as shown in the receiver schematic drawing, to adjust loudspeaker volume.

4. Connect a strap from terminal E28 to terminal E29. (Input terminal E28 is used for remote squelch control in repeater

applications and is not normally used in other applications.)

5. Connect a 50 KOhm potentiometer to terminals E30, E31, and E32 as shown in the receiver schematic diagram. This potentiometer is used for setting the receiver squelch threshold. Shielded wire should be used for making these connections.

6. To obtain a logic output signal indicating the presence of received signal connect to terminal E16. Output E16 provided a ground when received signal is present and an open when no received signal is present.

If an inverted logic signal is desired, connect a strap from terminal E16 to terminal E17 and take the output from terminal E15. Terminal E15 provides a open when received signal is present and a ground when no received signal is present.

7. If CTCSS operation is to be used, connect from terminals E18 (signal) and E19 (ground) to the CTCSS decoder input. Connect from the CTCSS decoder output to terminal E33. The logic signal connected to terminal E33 should provide a ground when a CTCSS signal is detected by the decoder and an open when no CTCSS signal is detected.

8. If metering is to be used, connect 0-1 mA meters having internal resistances of 2200 Ohms to the following terminals:

	Meter + Terminal	Meter - Terminal
Signal Strength	E27	Ground
Peak Deviation	E26	Ground
Discriminator	E20	Ground through series connected diodes

Adjust the signal strength meter by applying a strong (10,000 uV) signal to the receiver input and setting potentiometer R66 until compression begins (further rotation of the potentiometer causes no further change in the meter indication).

Set the discriminator meter by applying an on freqency signal to the receiver and adjusting potentiometer R54 for a center scale meter reading.

Set the peak deviation meter by applying a signal having 5KHz deviation to the receiver and adjusting potentiometer R64 for a center scale reading. Meter indication is directly proportional to deviation, i.e. 0.5 mA meter indication corresponds to 5 KHz deivation.

Alignment

All MR4 receivers are factory aligned prior to shipment and require no initial alignment. The information given below is intended to aid readjustment following component replacement; it is not a step-by-step alignment procedure. Perform only the adjustments pertaining to the receiver section having the replaced component.

1. The RF section may be aligned by applying a signal to the receiver input and connecting a selective RF monitor to terminal E1. Adjust helical resonator capacitors and coupling capacitors C4 and C15 to obtain a maximum indication on the monitor. Some interaction will be found between resonator H2 and capacitor C4 and between resonator H6 and capactior C15 so these adjustments should be repeated as necessary until no further increase in gain is obtained.

As adjustments are made, reduce the applied signal level to avoid saturating the amplifier transistors or the RF meter. When properly aligned the RF section will exhibit a gain of approximately 20 dB.

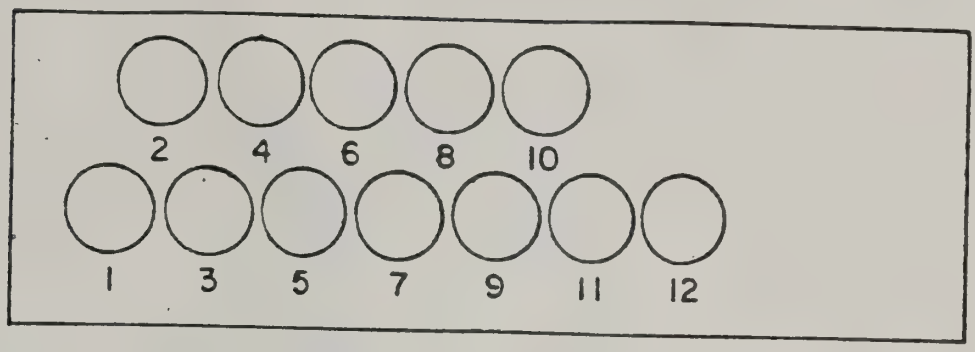
2. IF amplifier resonant circuits have a low Q so inductors L24 and L27 should not require adjustment in the field. The IF frequency can be set by loosely coupling a frequency counter to U1 terminal 1 and adjusting C107 to obtain a reading of 21.855 MHz.

3. The discriminator may be adjusted by applying an on-frequency, deviated signal to the receiver input and adjusting L28 for maximum output audio. The adjustment of L28 is not critical and will be found to have a broad maximum.

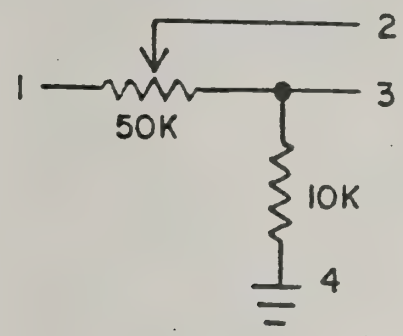
4. Receiver frequency may be set by applying an on-frequency signal to the receiver and adjusting capacitor C24 to obtain a center scale reading on the discriminator meter. In multi-frequency receivers, apply a ground to terminals E14, E11, E5, and E8 in turn to select the appropriate crystal and sdjust capacitors C28, C26, C22, and C24 respectively.

5. Multiplier stages may be adjusted by connecting a selective RF monitor to test point TP4 and adjusting the tuning components (inductors and capactiors) for a maximum indication on the monitor. When the multipliers are operating properly, the injection voltage at TP4 should be greater than 300 mv.

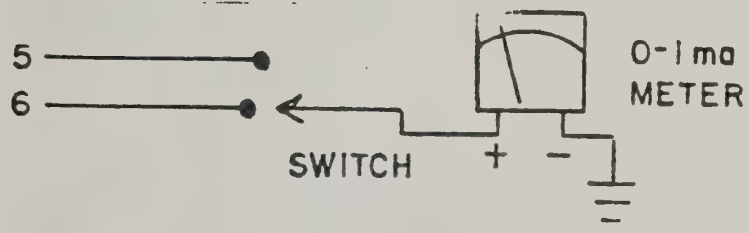
MR4 RECEIVER



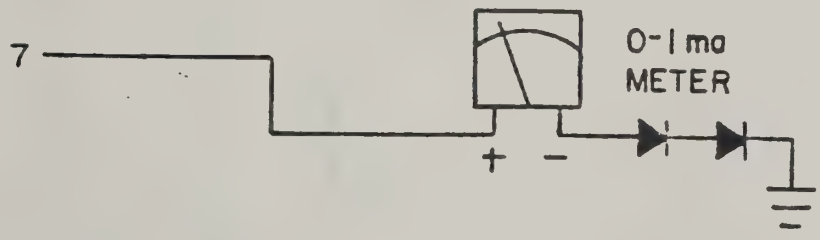
1. SQUELCH HIGH
2. SQUELCH WIPER
3. SQUELCH LOW
4. GROUND



5. S METER
6. PEAK DEVIATION



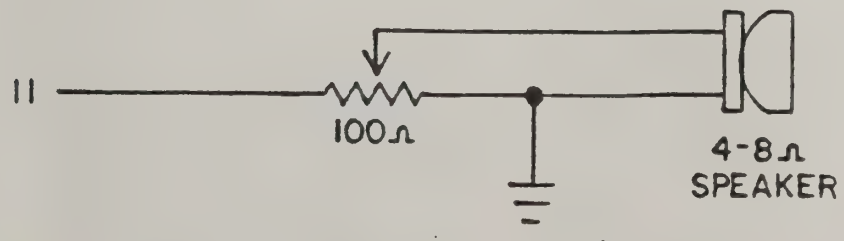
7. DISC METER



Disc Audio
8. ~~NO CONNECTION~~

9. COS LINE

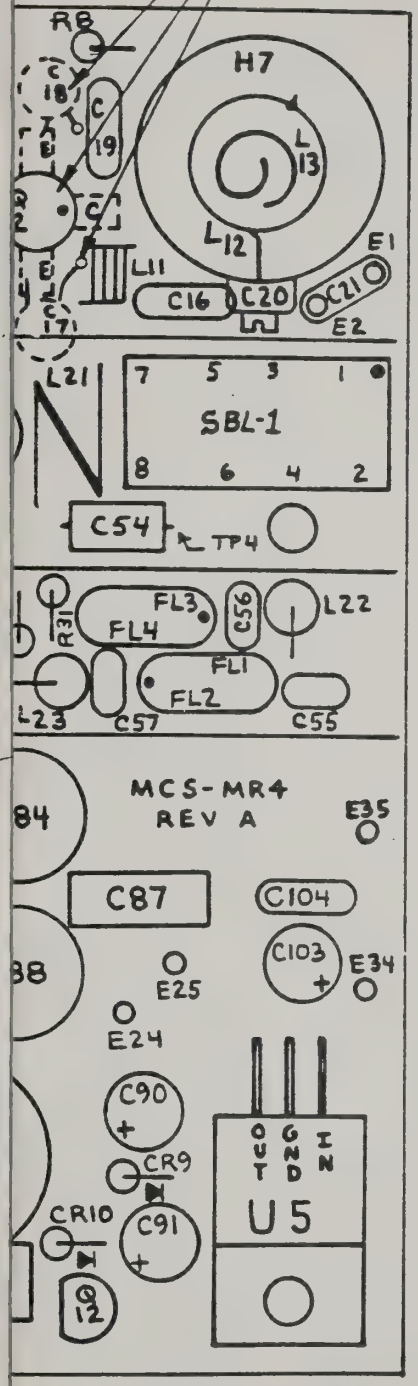
10. REPEAT AUDIO
11. LOCAL AUDIO



12. +12VDC INPUT

REV	DESCRIPTION	APP'D	DATE
A2	REVISED		10/14/83
A3	REVISED & RELEASED	WRD	11/3/83

INSTALL FARSIDE
Q2, C17, C18



CONTROL SPECIALTIES
PARK GROVELAND, MA. 01834

WILLIAM R. DEWHIRST DRAGONWYCK

SEMBLY DRAWING

C. BOARD REV A3 MCS - MRR

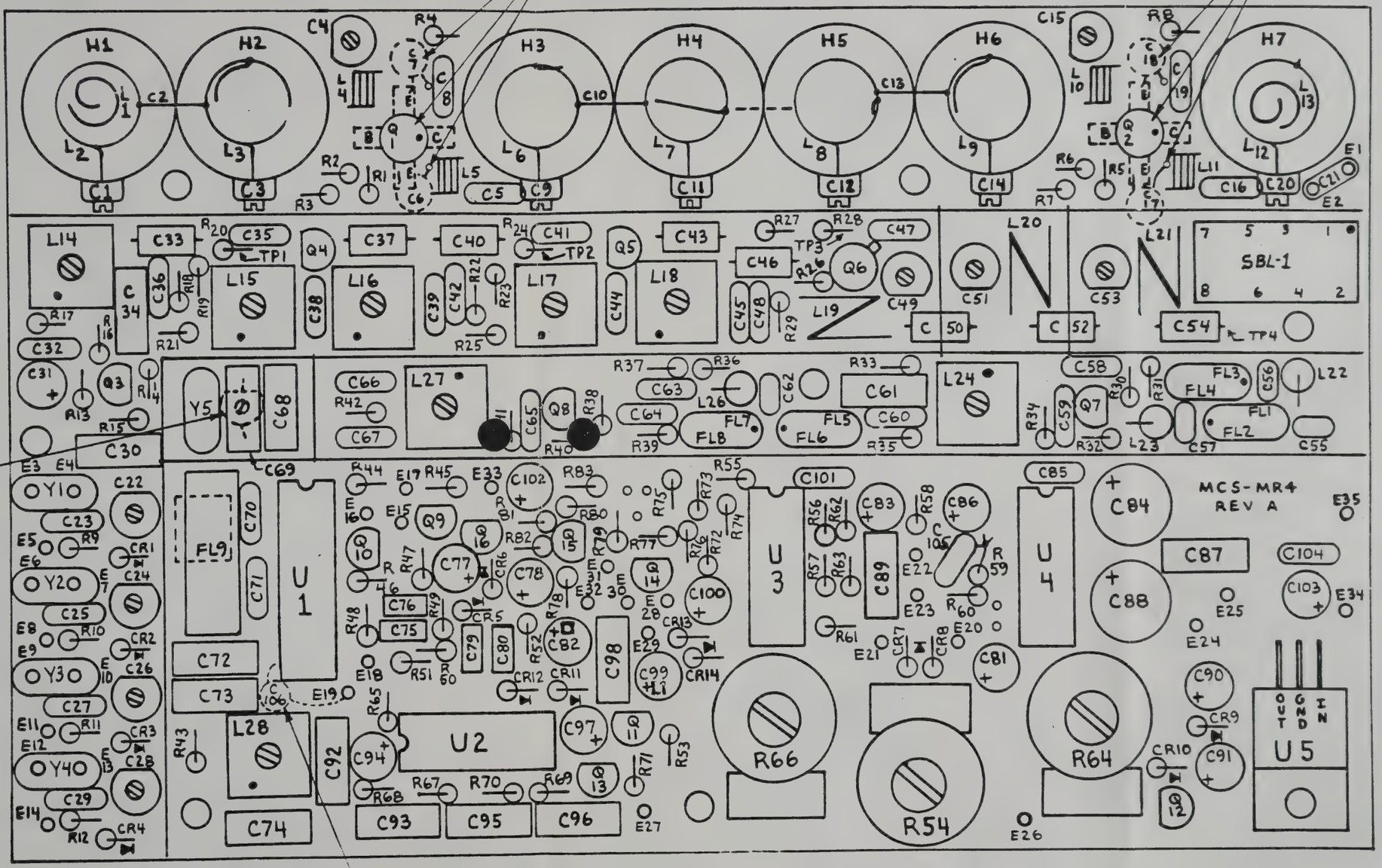
REV	DESCRIPTION	APP'D	DATE
A2	REVISED		10/26/83
A3	REVISED & RELEASED	WRD	11/3/83

INSTALL FARSIDE
Q1, C6, C7

INSTALL FARSIDE
Q2, C17, C18

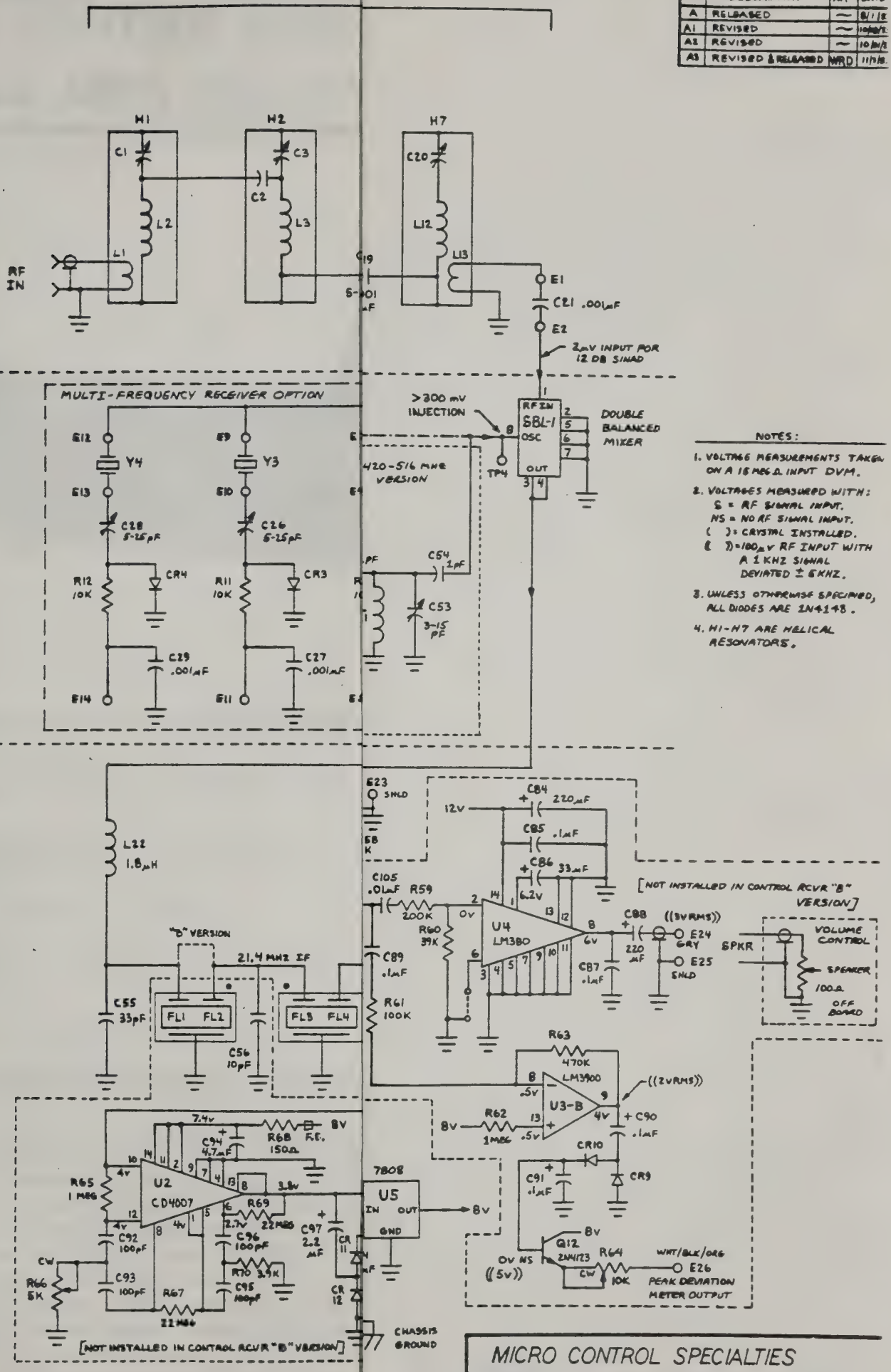
INSTALL FARSIDE
C107

INSTALL FARSIDE
C106



MICRO CONTROL SPECIALTIES		
23 ELM PARK GROVELAND, MA. 01834		
2 x 1		
B 23 83	WILLIAM R. DEWHIRST	DRAGONWYCK
ASSEMBLY DRAWING		
RECEIVER P.C. BOARD	REV A3 MCS - MRR	

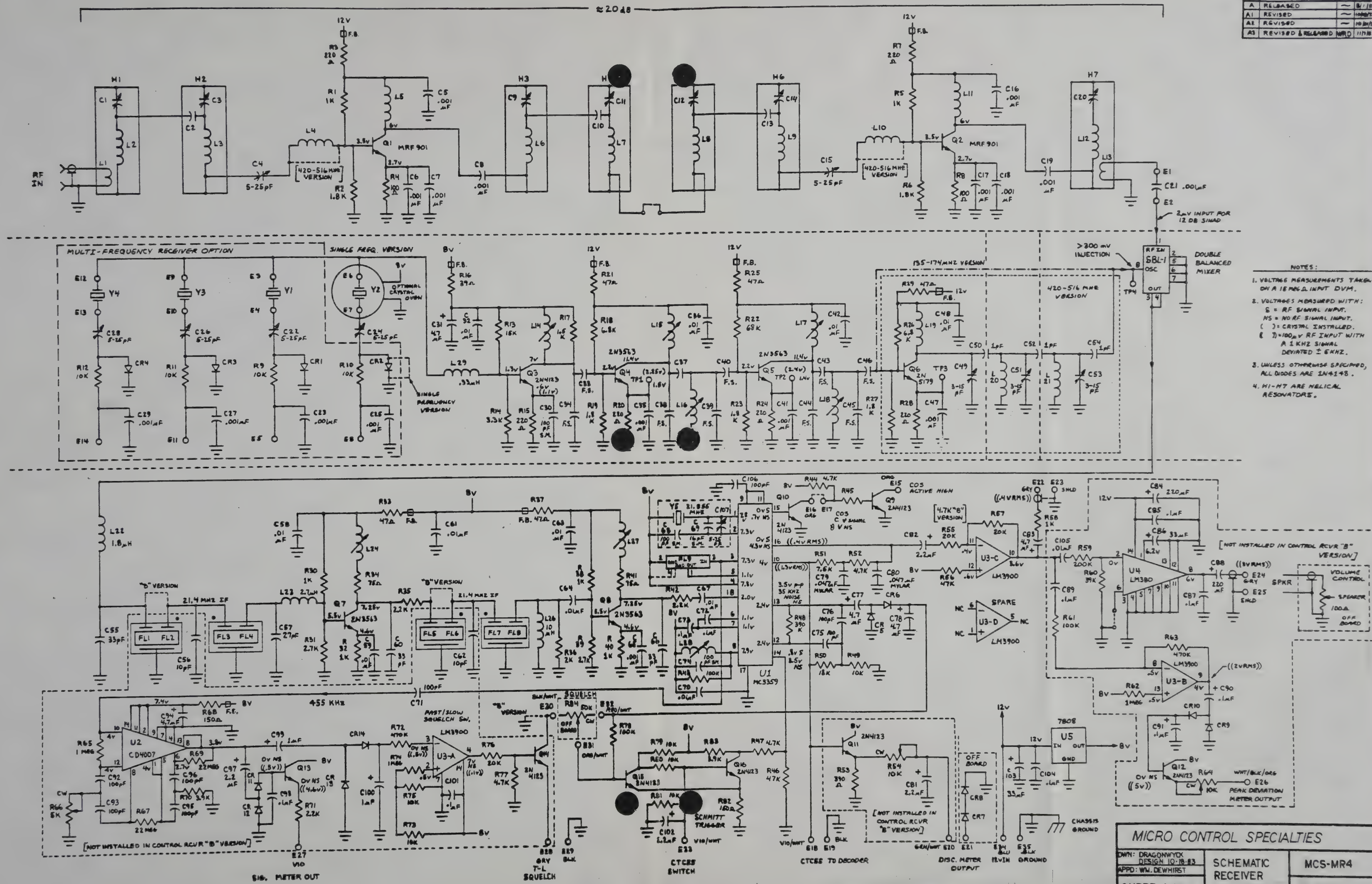
REV	DESCRIPTION	APP	DATE
A	RELEASED	—	8/1/18
A1	REVISED	—	10/30/18
A2	REVISED	—	10/31/18
A3	REVISED & RELEASED	WRD	11/9/18



MICRO CONTROL SPECIALTIES

DWN: DRAGONWYCK DESIGN 10-18-83 APPD: WM. DEWHIRST	SCHEMATIC RECEIVER P.C. BOARD	MCS-MR4
SHEET 1 OF 1		REV A3

REV	DESCRIPTION	APP	DATE
A	RELEASED	~	[illegible]
A1	REVISED	~	[illegible]
A2	REVISED	~	[illegible]
A3	REVISED & RELEASED	WRD	[illegible]



NOTES:

1. VOLTAGE MEASUREMENTS TAKEN ON A 15 MEG Ω INPUT DVM.
2. VOLTAGES MEASURED WITH:
   S = RF SIGNAL INPUT.
   NS = NO RF SIGNAL INPUT.
   ( ) = CRYSTAL INSTALLED.
   (( )) = 100 µV RF INPUT WITH A 1 KHZ SIGNAL DEVIATED ± 5 KHZ.
3. UNLESS OTHERWISE SPECIFIED, ALL DIODES ARE 1N4148.
4. H1-H7 ARE HELICAL RESONATORS.

MICRO CONTROL SPECIALTIES		
DWN: DRAGONWYCK DESIGN 10-18-83 APPD: WM. DEWHIRST	SCHEMATIC RECEIVER P.C. BOARD	MCS-MR4
SHEET 1 OF 1		REV A3

MICRO CONTROL SPECIALTIES
SERIES MR4 RECEIVER

COMPARE THESE MR4 FEATURES

- 7 large helical resonators for outstanding overload performance
- Double conversion with 21.4 MHz first IF for 120 dB image rejection
- 12-pole crystal and ceramic IF filter
- Automatic fast/slow squelch virtually eliminates squelch tail
- Squelch hysteresis follows fading signals
- Shielded oscillator/multiplier chain
- Metering circuits for signal strength, peak deviation, and discriminator
- Silver mica and mylar capacitors hold peak performance over temperature
- Provision for internal CTCSS decoder
- Feedback and Q-damping insures optimum performance over time and temperature

DESCRIPTION

Radio channels are crowded enough today -- tomorrow the congestion will be even worse. That's why every detail of the MR4 is designed for outstanding performance in the harshest RF environments. With 7 large helical filters in the front-end and 12 poles of IF filtering the MR4 is immune to desense at interference levels greater than 100,000 uV. Two of the resonators are placed ahead of the RF pre-amplifier for exceptional overload resistance. The 21.4 MHz first IF and shielded oscillator/multiplier chain make it difficult to even measure an image, and its double-balanced first and second mixers reject intermodulation products by 80 dB. Feedback, damped-Q tuned circuits and decoupling are used so that gain stages operate conservatively -- not wide open. NPO and mylar capacitors keep the performance consistantly high over temperature extremes.

The MR4 is also packed with operational features like our famous MCS squelch circuit which is often called "the best there is." Now we've added automatic fast/slow squelch to lock in on weak signals and virtually eliminate squelch tails on strong signals. Full metering provisions for signal strength, deviation, and discriminator are included as are line and local speaker audio outputs.

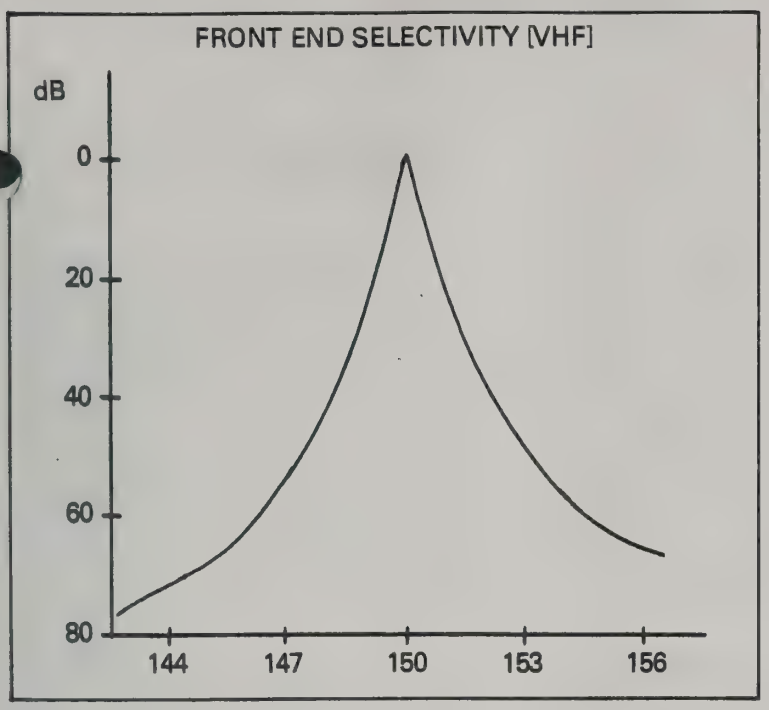
Compare all the MR4 specs with those of any other receiver. Nothing else matches the MR4!

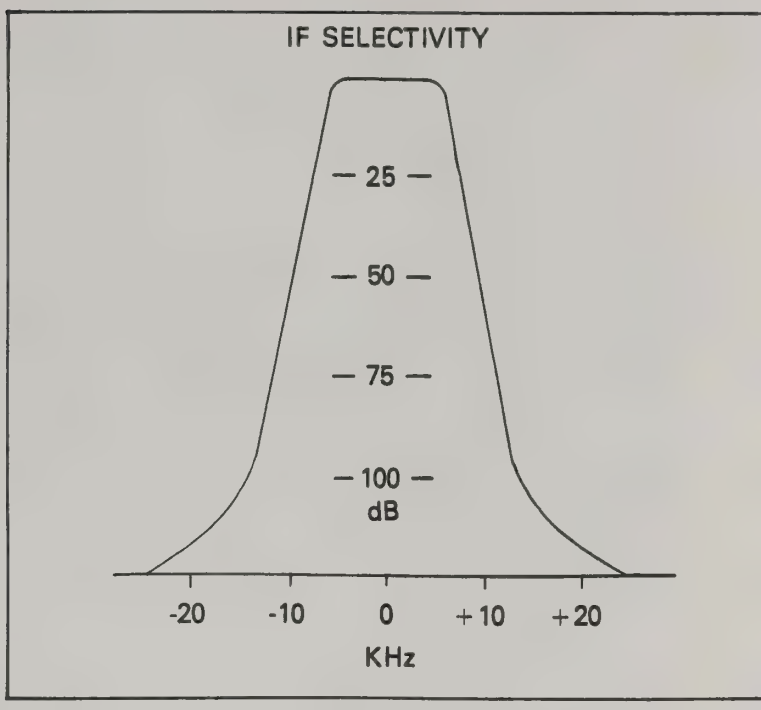
SPECIFICATIONS

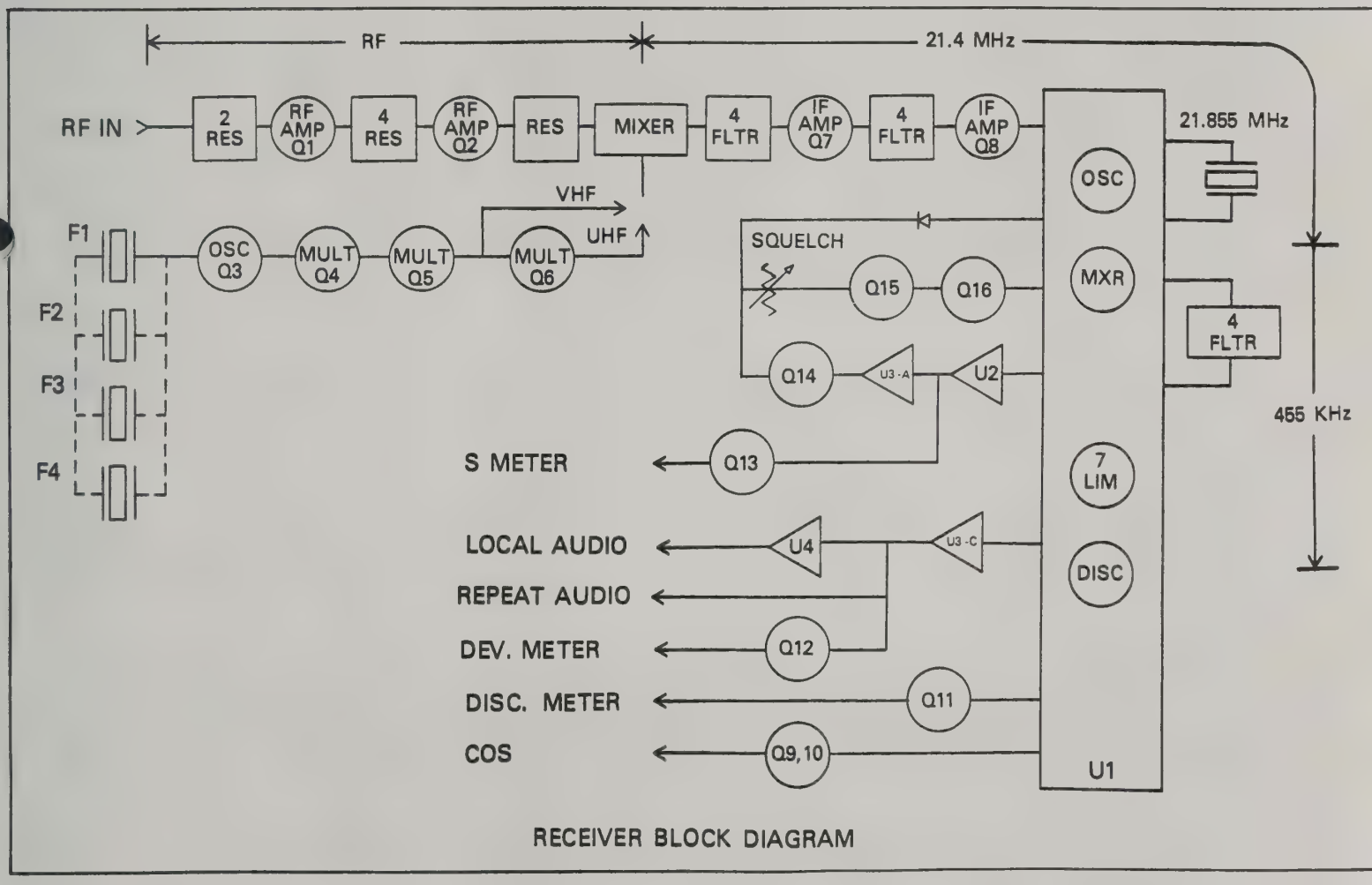
Frequency Range	136-174MHz, 216-250MHz (VHF) 420-512MHz (UHF)
Sensitivity	.25-.35uV (typ.) for 12dB SINAD
Selectivity	-6dB at ± 6.5KHz -105dB at ± 15KHz -125dB at ± 25KHz
Spurious and Image response	-85dB Spurious -125dB Image
Overload/Desense	75,000uV ± 600KHz (VHF) 100,000uV ± 2MHz (VHF) 75,000uV ± 2MHz (UHF) 100,000uV ± 5MHz (UHF)
Intermodulation	-80dB (EIA method)
I.F.	21.4MHz first, 455KHz second
I.F. Filtering	8-pole crystal at 21.4MHz 4-pole ceramic at 455KHz (optional 9-pole ceramic)
First oscillator stability	±.0005% (-10 to +60C) ±.0002% with optional oven
Squelch Circuit	Schmitt trigger with 6dB hysteresis
Squelch Threshold	.1-.15uV, automatic switch to fast mode with signals greater than 10uV
Modulation acceptance	±7KHz
Audio de-emphasis	-6dB/octave (EIA)
Audio output	1.5W into 4Ω (local) 0.4Vrms, 1000Ω (line/repeat)
External Controls	50KΩ squelch 100 Ω local audio
External metering	0-1mA, 2300Ω for each function
COS output	open collector, selectable active high or low
Voltage required	13VDC nominal (11-14VDC limit)
Current Drain	180mA squelched 200mA nominal unsquelched 250mA with full audio output
Crystal specification	136-151MHz Fx = (Fo−21.4MHz) /2 151-174MHz Fx = (Fo-21.4MHz) /3 216-250MHz Fx = (Fo−21.4MHz) /4 420-512MHz Fx = (Fo-21.4MHz) /8 Parallel resonant, third overtone, resistance 30Ω max., 12pF load capacity, HC-25/U case
Physical [modular version]	5''x7.25''x2.5'' enclosure w/ feedthru capacitors & UHF connector
Physical [rack version]	19''x5.25'' rack panel, 5'' deep includes meters, controls, and speaker

Specifications subject to change without notice

MR4 receivers are factory tested, aligned, and tuned to frequency before shipment. They are engineered to give years of reliable service with no periodic adjustment or maintenance. Their one year limited warranty is our statement of commitment to quality.







RECEIVER BLOCK DIAGRAM

MICRO CONTROL SPECIALTIES

DIV. OF KENDECOM INC.

23 Elm Park, Groveland, MA 01834 (508) 372-3442
Kendecom Fax: (508) 373-7304

MR4 RECEIVER

Circuit Description

The receiver RF input circuit consists of seven high-Q helical resonators (H1-H7), two amplifier transistors (Q1, Q2) and associated components. The gain of this circuitry at the RF input frequency is nominally 20 dB. Superior intermodulation performance is obtained by passing input signals through two helical resonators (H1, H2) to reject out-of-band energy before amplification. Both amplifier transistors use high bias current for maximum overload capability and minimum distortion. Feedback is used to stailize amplifier operation against temperature variations, and two sections of power supply decoupling per stage further insure stable operaion. The RF circuit output connects to the input of double balanced mixer SBL-1.

Mixer injection voltage is generated by oscillator and multiplier stages consisting of transistors Q3 through Q6 and associated components. Q3 fucntions as a fundamental frequency oscillator at a frequency determined by crystals Y1 through Y4. In single frequency receivers, diode CR2 is replaced by a strap to cause crystal Y2 to be selected as the frequency determining element. Y2 may be enclosed by an optional proportional crystal oven in applications at UHF frequencies where the receiver is subject to wide temperature variations. In multi-frequency receivers, oscillator frequency is determined by providing a ground on terminal E5, E8, E11, or E14 to select the associated crystal. The multiplication ratios of Q4 through Q6 depend upon the frequency range of the receiver as follows:

Frequency Range in MHz	Multiplier Q4	Q5	Q6
136 - 151	Doubler	Amplifier	Not used
151 - 174	Tripler	Amplifier	Not used
216 - 250	Doubler	Doubler	Not used
420 - 512	Doubler	Doubler	Doubler

High frequency crystal are used in the MR4 receiver to minimize the number of possible image frequencies by reducing the total multiplication ratio needed to obtain the required injection frequency. To further reduce image levels, double-tuned filters are used between all multiplier stages.

The double balanced mixer output is fed to the high-IF amplifier section which consists of two transistors (Q7, Q8), eight crystal filter sections, and associated components ('B' version command receivers use four filter sections.) The high-IF operates at a frequency of 21.4 MHz. Both amplifier stage outputs include broadly

tuned resonant circuits (L24, C60 and L27, C66 respectively) to reject signals at frequencies beyond the skirts of the ceramic filters. Generous feedback and decoupling desensitize the amplifiers to temperature and power supply effects.

Conversion from high to low IF frequencies, amplification at the low IF frequency, limiting, and detection is done by integrated circuit U1 (squelch circuitry in U1 is not used). Frequency conversion is controlled by crystal Y5 which operates in conjuction with oscillator circuitry contained in U1. Four pole ceramic filter FL-9 operates at the low IF frequency of 455 KHz to provide additional filtering. Seven amplifier stages contained in U1 provide excellent limiting before detection. Detection is done by discriminator circuitry contained in U1 operating in conjunction with coil L28.

Wideband demodulated audio from U1 is detected by diodes CR5 and CR6 to provide the primary voltage reference for squelch operation. This detected voltage is fed to a Schmitt trigger circuit consisting of transistors Q15 and Q16. Hysteresis in the Schmitt trigger produces positive squelch action by requiring a change of about 6 dB in noise level before receiver audio is switched from off to on. The detected reference voltage is applied to the Schmitt trigger through squelch control R84 (R84 is external to the MR4.) Action of the Schmitt trigger can also be controlled by an external CTCSS decoder to disable receiver audio when no CTCSS signal is present. In applications where CTCSS operation in used, the CTCSS decoder output connects to terminal E33 to contol Schmitt trigger operation.

Squelch operation is further enhanced in the MR4 by automatically adjusting the squelch threshold in accordance with received signal level. Received signal at the low IF frequency is amplified by linear amplifier U2. detected by CR13/ CR14, level shifted by U3A, and fed to fast/slow squelch switch transistor Q14. When weak signals, less than 1 uV, are applied to the receiver transistor Q14 is turned on and applies a ground at terminal E30 to produce normal squelch action. When strong signals, greater than 1 uV, are applied to the receiver transistor Q14 is switched off. With Q14 turned off the reference voltage at the Schmitt trigger input is increased causing the squelch to be 'tightened.' 'Tightening' the squelch causes faster operation in response to signal changes and virtually eliminates squelch tail noise. Thus, the MR4 provides high squelch sensitivity to weak signals and noise-free operation for strong signals.

Output from the Schmitt trigger gates the audio output of U1. When a received signal is present audio from U1 is passed to amplifier U3C. Line audio is taken from the output of U3C at terminal E22. Audio from U3C is also routed to power amplifier U4 for driving a local speaker.

Metering circuits are provided to monitor signal strength, discriminator centering, and received signal peak deviation (Metering is not provided in version 'B' command receivers). All metering circuits are designed to drive 0-1 mA, 2200 Ohm panel meters. Signal strength metering is available at terminal E27 which is driven by DC amplifier transistor Q13. The signal strength meter indication is

calibrated using potentiometer R66. DC amplifier transistor Q11 drives terminal E20 to provide discriminator metering. Potentimeter R54 allows the discriminator meter to be set to mid-scale when registering an on-frequency signal. The discriminator meter negative terminal should be returned to ground through two series connected diodes. Diodes CR7 and CR8 are provided external to the receiver module for this purpose when the MR4 is factory installed in a repeater or rack panel. Audio is amplified, rectified by CR)/ CR10, and level shifted by Q12 to drive peak deivation metering outut terminal E26. Metering calibration is done using poteniometer R64.

Switched outputs indicating the presence of received signal are available from Q9 or Q10. Q10 provides a ground at terminal E16 when received signal is present and an open when no signal is present. An inverted output can be obtained by connecting a strap from terminal E16 to terminal E17 and taking the output from terminal E15.

Installation

The following describes connections which may be made to MR4 receivers furnished in modular form. Receivers furnished in repeaters are completely connected and require no field installation.

1. Connect to receiver terminals E34 (positive) and E35 (ground) from a DC power source having the following characteristics:

Nominal voltage	12 VDC
Regulation	+/- 5%
Ripple	< 100 mV
Current	250 mA

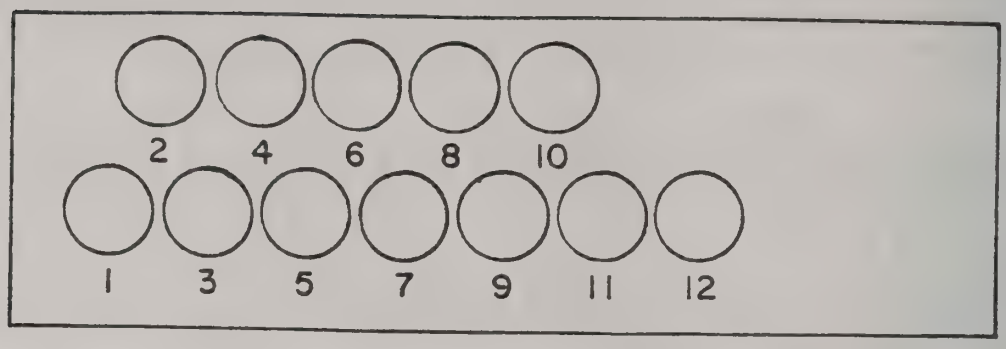
CAUTION: The MR4 uses negative ground and must be powered from a negative ground or floating power supply. DO NOT connect a positive ground power source to the receiver.

2. To obtain a fixed-level audio output (line audio) connect to terminals E22 (signal) and E23 (ground). This output provides a level of approximately 0.4 vrms and a source impedance of 1000 Ohms. Shielded wire should be used for making this connection.

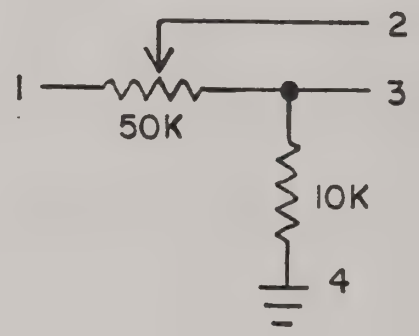
3. To obtain power amplifier audio output for driving a loudspeaker connect to terminals E24 (signal) and E25 (ground). This output provides a fixed level of approximately 3 vrms. An external 100 Ohm potentiometer may be connected between this output and the loudspeaker, as shown in the receiver schematic drawing, to adjust loudspeaker volume.

4. Connect a strap from terminal E28 to terminal E29. (Input terminal E28 is used for remote squelch control in repeater

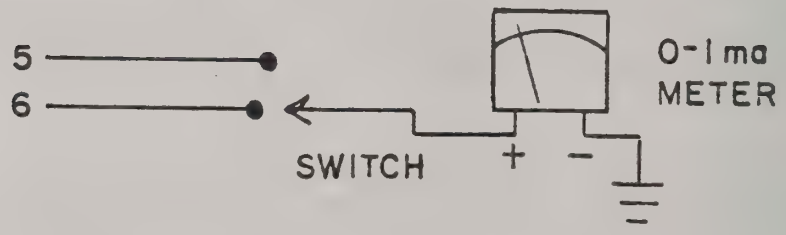
MR4 RECEIVER



1. SQUELCH HIGH
2. SQUELCH WIPER
3. SQUELCH LOW
4. GROUND

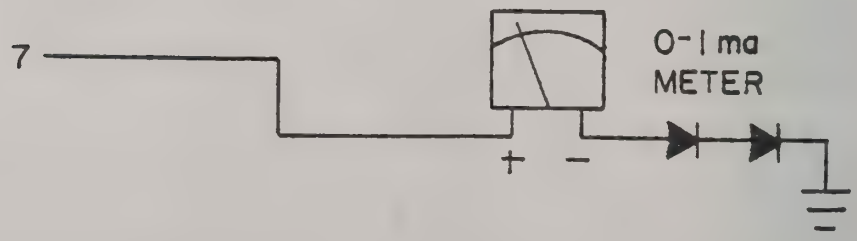


5. S METER
6. PEAK DEVIATION

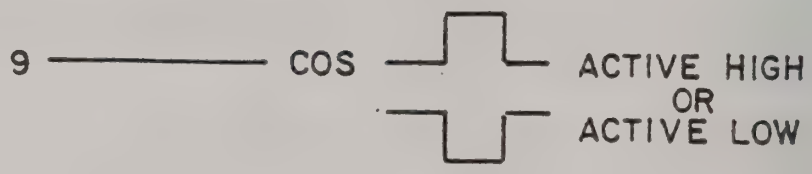


7. DISC METER

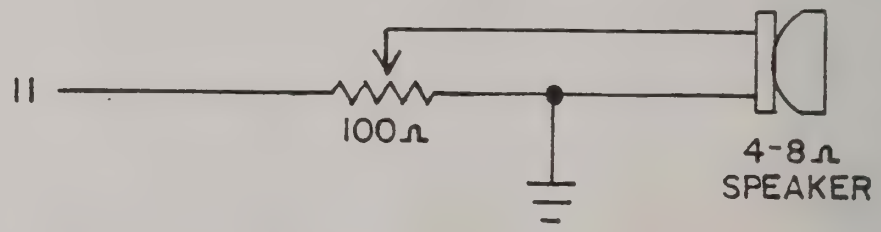
8. NO CONNECTION



9. COS LINE

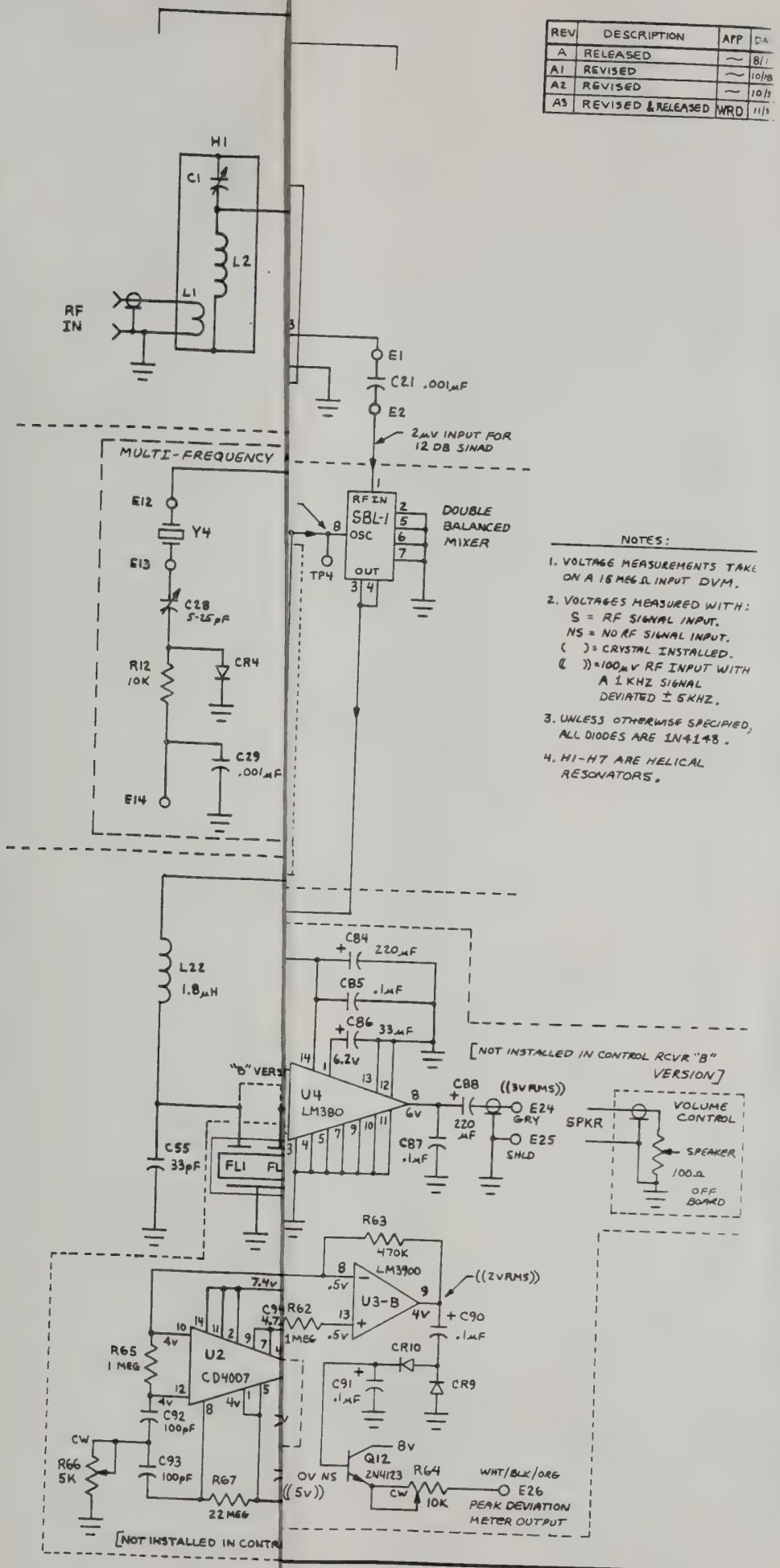


10. REPEAT AUDIO
11. LOCAL AUDIO



12. +12VDC INPUT

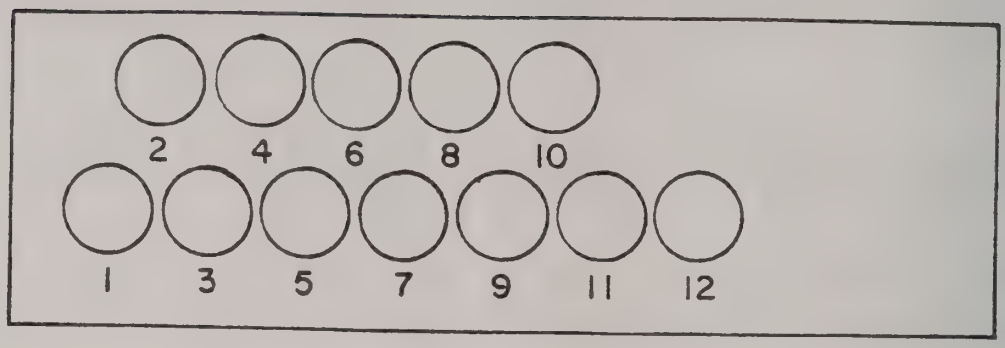
REV	DESCRIPTION	APP	DA
A	RELEASED	~	8/
A1	REVISED	~	10/
A2	REVISED	~	10/
A3	REVISED & RELEASED	WRD	11/



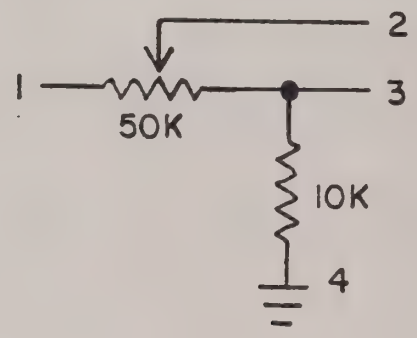
MICRO CONTROL SPECIALTIES

N: DRAGONWYCK DESIGN 10-18-83 D: WM. DEWHIRST	SCHEMATIC RECEIVER P.C. BOARD	MCS-MR4
HEET 1 OF 1		REV A3

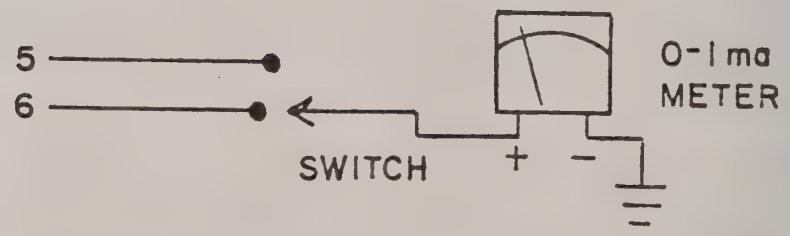
MR4 RECEIVER



1. SQUELCH HIGH
2. SQUELCH WIPER
3. SQUELCH LOW
4. GROUND

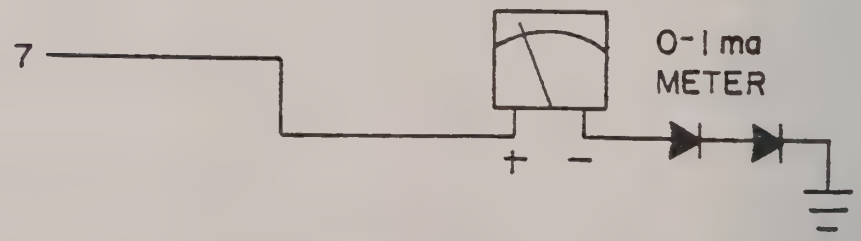


5. S METER
6. PEAK DEVIATION



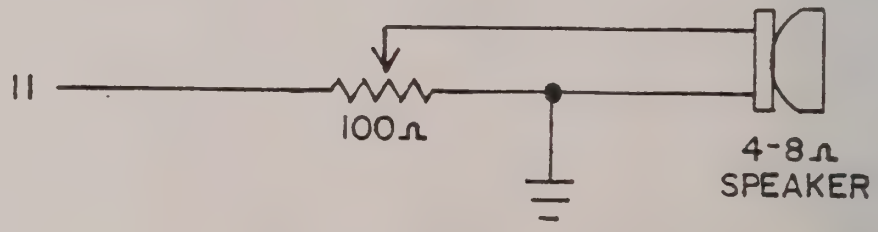
7. DISC METER

8. NO CONNECTION



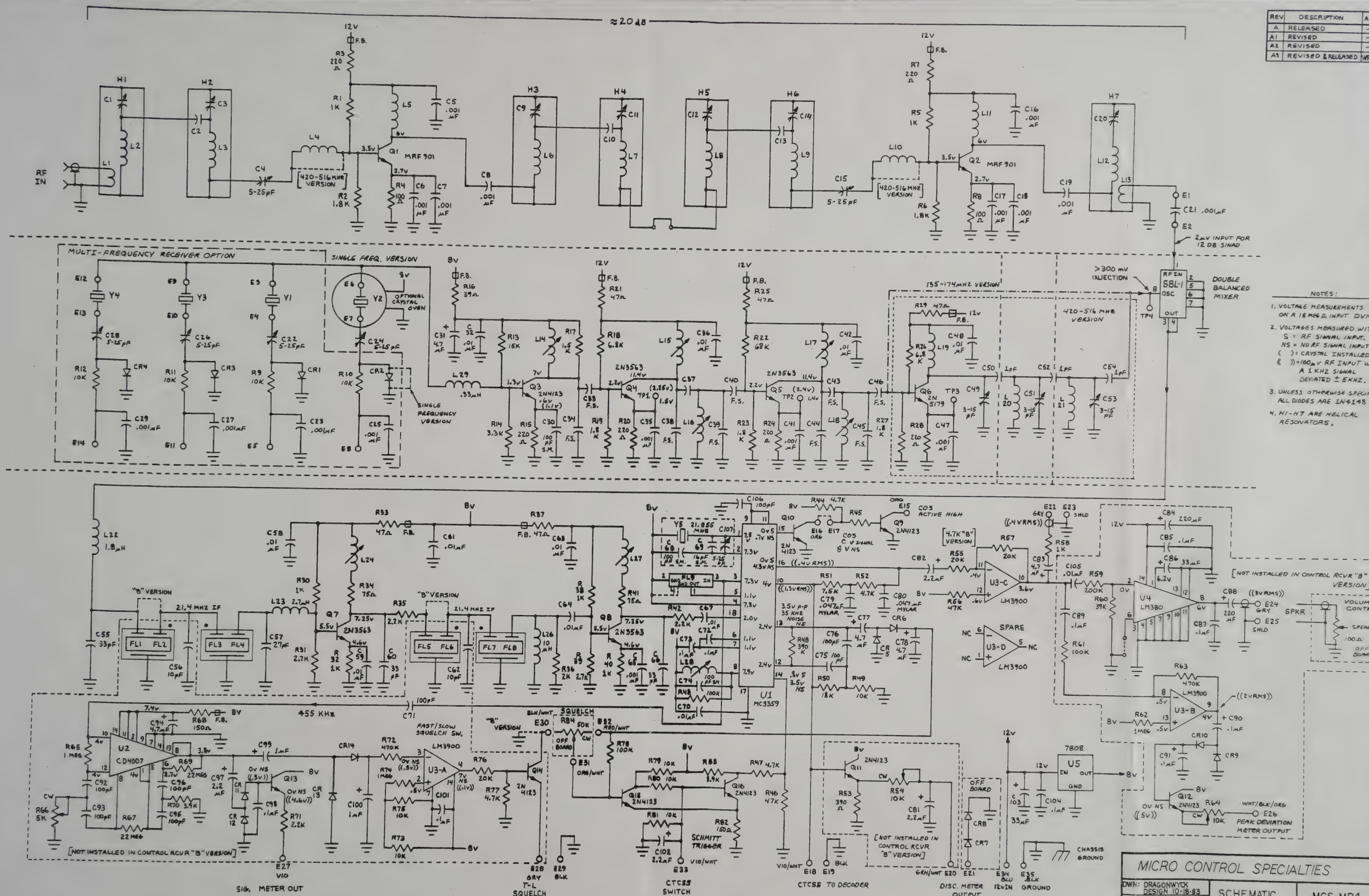
9. COS LINE

10. REPEAT AUDIO
11. LOCAL AUDIO



12. +12VDC INPUT

REV	DESCRIPTION	APP	DA
A	RELEASED	~	8/.
A1	REVISED	~	10/18
A2	REVISED	~	10/13
A3	REVISED & RELEASED	WRD	11/1



NOTES:

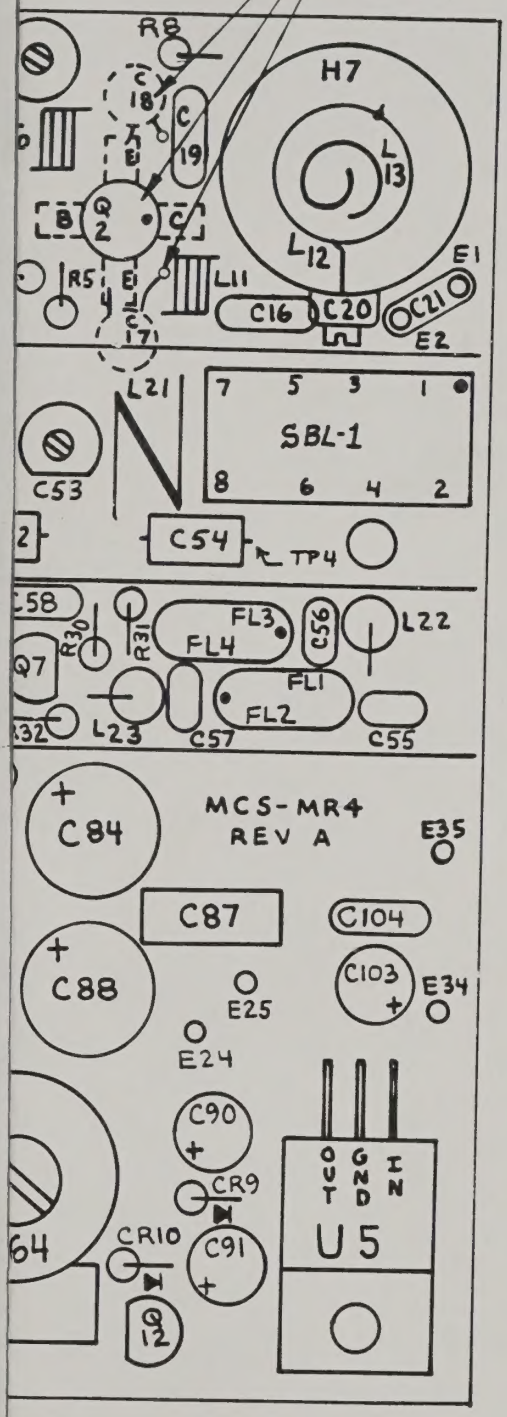
1. VOLTAGE MEASUREMENTS TAKEN ON A 15 MEG Ω INPUT DVM.
2. VOLTAGES MEASURED WITH:
   S = RF SIGNAL INPUT.
   NS = NO RF SIGNAL INPUT.
   ( ) = CRYSTAL INSTALLED.
   (( )) = 100μv RF INPUT WITH A 1 KHZ SIGNAL DEVIATED ± 5KHZ.
3. UNLESS OTHERWISE SPECIFIED, ALL DIODES ARE 1N4148.
4. H1-H7 ARE HELICAL RESONATORS.

MICRO CONTROL SPECIALTIES		
DWN: DRAGONWYCK DESIGN 10-18-83	SCHEMATIC RECEIVER P.C. BOARD	MCS-MR4
APPD: WM. DEWHIRST		
SHEET 1 OF 1		REV A3

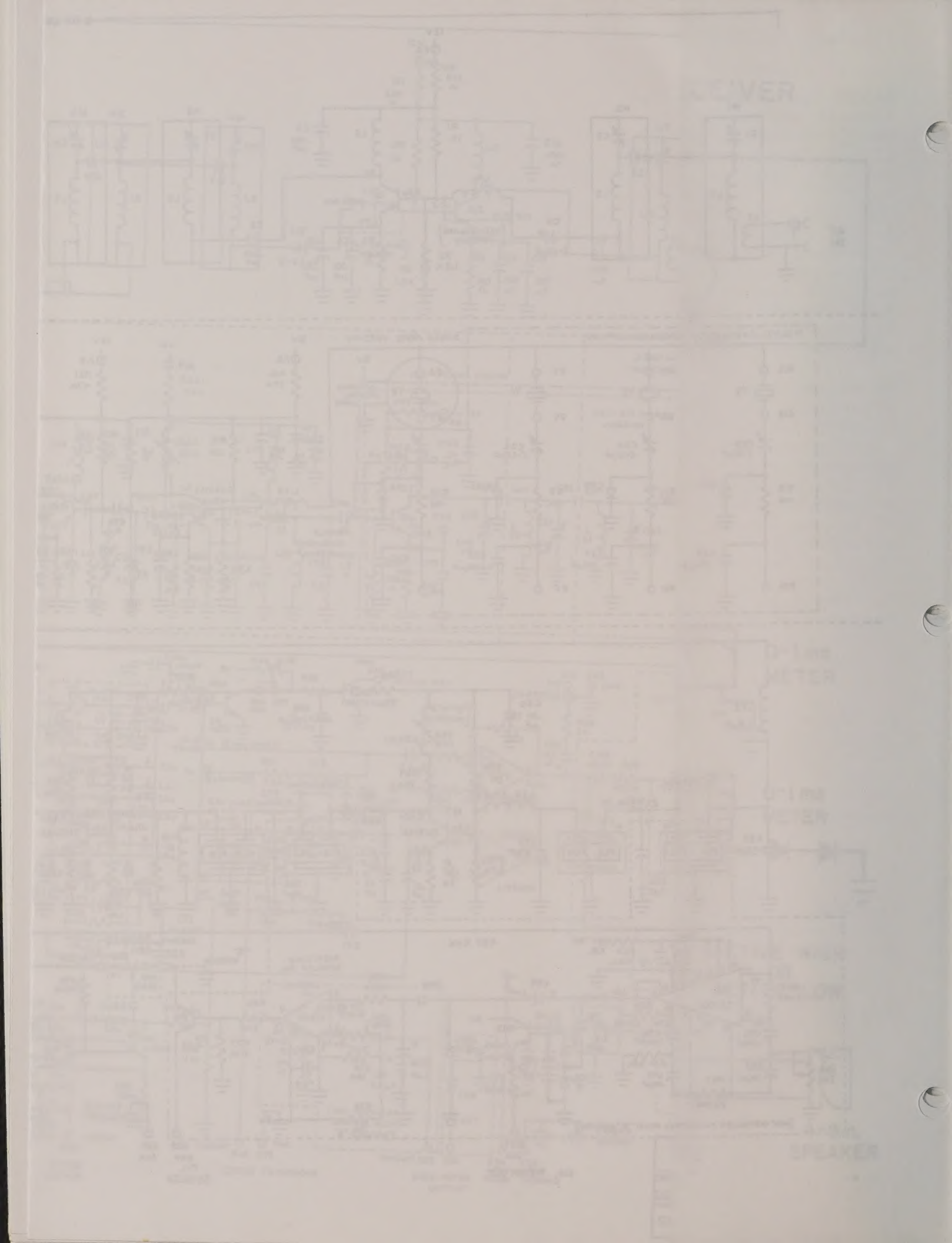
REV	DESCRIPTION	APPD	DATE
A2	REVISED		10/24/83
A3	REVISED & RELEASED	WRD	11/3/83

INSTALL FARSIDE
Q2, C17, C18

INSTALL FARSIDE
C107



MICRO CONTROL SPECIALTIES	
3 ELM PARK GROVELAND, MA. 01834	
x 1	
23 83 WILLIAM R. DEWHIRST	DRAGONWYCK
ASSEMBLY DRAWING	
VER P.C. BOARD	REV A3 MCS - MRR



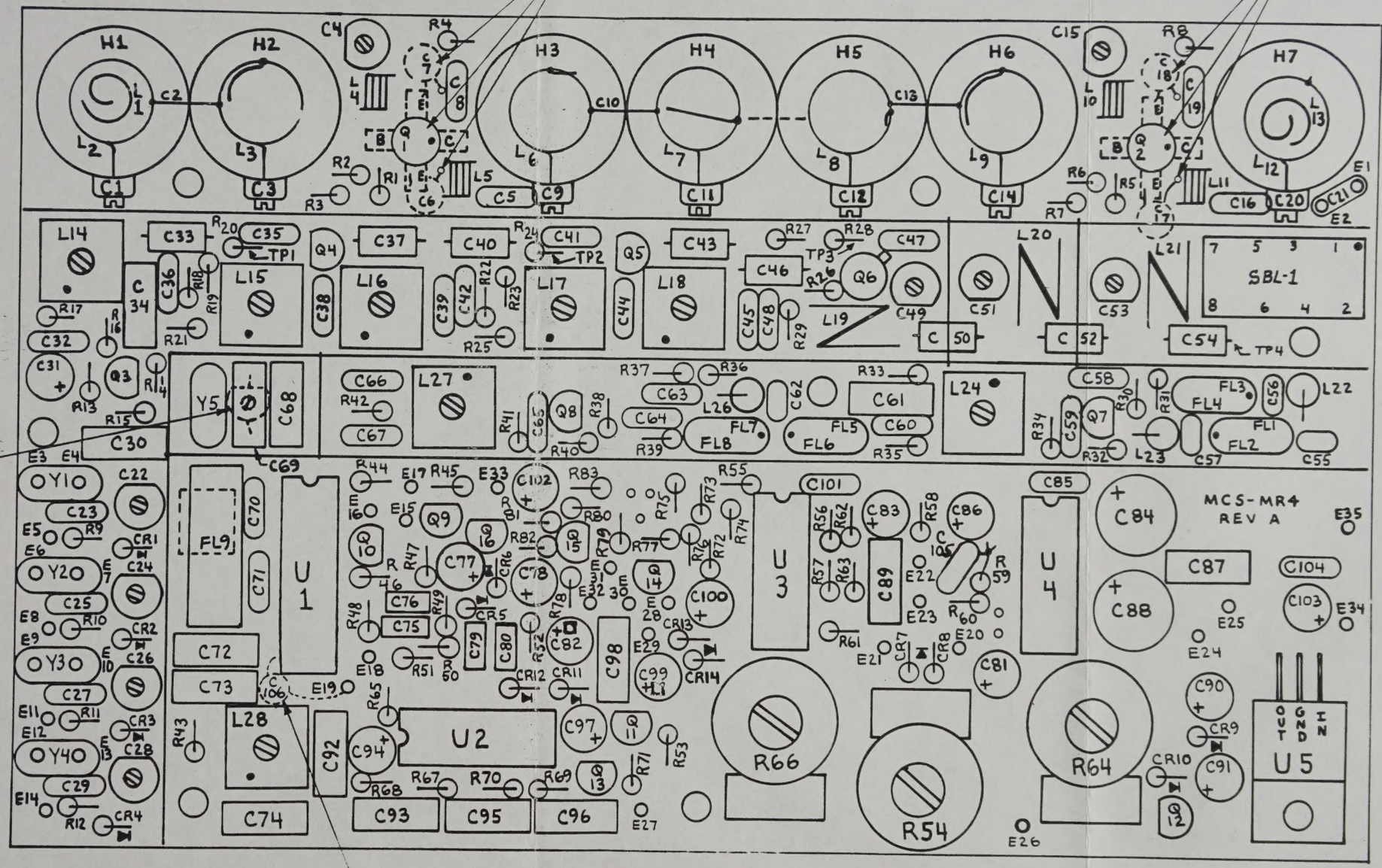
REV	DESCRIPTION	APP'D	DATE
A2	REVISED		10/14/83
A3	REVISED & RELEASED	WRD	11/3/83

INSTALL FARSIDE
Q1, C6, C7

INSTALL FARSIDE
Q2, C17, C18

INSTALL FARSIDE
C107

INSTALL FARSIDE
C106



MICRO CONTROL SPECIALTIES
23 ELM PARK GROVELAND, MA. 01834

2 x 1		
8 23 83	WILLIAM R. DEWHIRST	DRAGONWYCK

ASSEMBLY DRAWING

RECEIVER P.C. BOARD REV A3 MCS - MRR


INSTALL FARSIDE
C1,C6,C7